PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
SANDRA POTEAT THOMPSON
RIORDAN & MCKINZIE
THREE EMBARCADERO CENTER
SAN FRANSCISCO, CA 94111-4067

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing *(day/month/year)*	09 JUL 2004

Applicant's or agent's file reference	IMPORTANT NOTIFICATION
52-020-001 722020600\322000	

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US03/11153	10 April 2003 (10.04.2003)	11 April 2002 (11.04.2002)

Applicant

HONEYWELL INTERNATIONAL INC.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450	Vasu Jagannathan
Facsimile No. (703) 305-3230	Telephone No. 703-308-0661

Form PCT/IPEA/416 (July 1992)

Mary Zimmer 571-272-1096

722020-6001

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 52-020-001	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US03/11153	International filing date *(day/month/year)* 10 April 2003 (10.04.2003)	Priority date *(day/month/year)* 11 April 2002 (11.04.2002)
International Patent Classification (IPC) or national classification and IPC IPC(7): C08G 77/08,77/12, 77/20; C08K 03/08, 03/36, 03/38; C08L 83/00 and US Cl.: 106/287.13; 524/404,439,440,492,493,588; 528/15,31,32		
Applicant HONEYWELL INTERNATIONAL INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03 November 2003 (03.11.2003)	26 May 2004 (26.05.2004)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Vasu Jagannathan Telephone No. 703-308-0661

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US03/111[redacted]

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed.

☒ the description:
pages 1-23 as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☒ the claims:
pages NONE, as originally filed
pages 24-28, as amended (together with any statement) under Article 19
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☐ the drawings:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages NONE

☐ the claims, Nos. NONE

☐ the drawings, sheets/~~fig~~ NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*
*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims	1-64	YES
	Claims	NONE	NO
Inventive Step (IS)	Claims	1-64	YES
	Claims	NONE	NO
Industrial Applicability (IA)	Claims	1-64	YES
	Claims	NONE	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-64 meeet the criteria set out in PCT Article 33(2)-(3), because while the prior art discloses a composition comprising a plurality of organosiloxane polymers/oligomers, microparticles of an inorganic substance, and a thermally-conductive filler, it does not teach or fairly suggest this combination of materials wherein the polymers possess different solubility parameters that will separate into different phases upon mixing.

Claims 1-64 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

---------- NEW CITATIONS ----------

none

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the questions whether the claims are fully supported by the description, are made:

Claims 1-64 are objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6. These claims are all indefinite because the precise meaning of the phrase "solubility parameter" is unclear. For instance, it cannot be ascertained whether this is a property that is calculated based on emperical methods or, alternatively, merely a qualitative statement describing the miscibility of two or more materials. Beyond this, the claims seem to indicate that, where there are more than two organosilicon compounds present, each one would have a meaningfully distinct solubility parameter. Hence, it is expected that one of ordinary skill would observe a multiphasic system when these components are blended having a number of microphases equal to the number of different organosilicon compounds present. However, page 9, lines 3-5 state that, in the situation outlined above, only two separated microphases are formed.

Based on the specific example provided on page 21 of the description, it appears that the shortcomings in the claim language are due, at least in part, to Applicant's allusion to two siloxane-based *compounds* as opposed two siloxane-based *mixtures*. There are a total of six different organosiloxane compounds making up Parts A and B but it is predicted that at least three of these, vinyl-terminated polydimethylsiloxane, dimethylsiloxane-methylhydrosiloxane copolymer, and vinylmethylcyclotetrasiloxane, would be fully miscible with one another and, thus, would have similar "solubility parameters". Likewise, it is predicted that the siloxane compounds bearing higher alkyl substituents would also be miscible with one another. These two groups of compounds may presumably separate into two distinct phases as is suggested by the description at page 9, lines 3-5 but it is still not evident as to why the materials constituting these groups would have different solubility parameters.

Another possibility is that Parts A and B in the Example have different solubility products and, therefore, do not form homogeneous mixtures but this hypothesis is inconsistent with the language of the claims. Ultimately, the intentions of Applicant are unclear based on the ambiguity of the language employed.

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Claims 1-10, 12, 14, 16, 18-22, 25-44, 46, 48, 50, 52, 56, and 59-64 lack novelty under PCT Article 33(2) as being anticipated by Mine et al., US 6,040,362. Mine discloses a heat conducting polymer composition comprising (a) an organopolysiloxane bearing at least two alkenyl groups per molecule, (b) an organohydrogensiloxane bearing at least two silicon-bonded hydrogen atoms per molecule, and (c) a hydrosilylation catalyst. Detailed descriptions of each of these materials are provided in order in columns 2-4. In addition to the elastomer-forming materials, heat-conducting powders (d) in the form of metal powders coated with a metal oxide layer or a metal nitride layer are provided (column 7, lines 1-33). Adhesion promoters and inorganic fillers such as fumed silica (column 6, lines 51-54) are other useful materials that are favorably blended into the elastomer matrix. Relevant to claims 27-34 and 61-64, column 8, lines 29-41 contemplate the utilization of this composition for dissipating heat from electronic devices and, more particularly, semiconductors.

Claims 1-8, 11-12, 15-19, 21-26, 35-42, 45-46, and 49-60 lack novelty under PCT Article 33(2) as being anticipated by Theodore et al., US 4,292,225. Theodore discloses a thermally-conductive silicone elastomer composition comprising (I) a polydiorganosiloxane preferably fitting the description outlined in the paragraph bridging columns 3 and 4 to which is added particulate silica having the particle size set forth in column 4, lines 18-28 and a platinum hydrosilylation catalyst (column 4, lines 52-53), (II) an organohydrogensiloxane oligomer satisfying the description offered in column 6, lines 13-61, (III) boron nitride, and (IV) a viscosity modifier according to column 5, lines 34-58. Other optional ingredients are identified at the top of column 7.

Claims 11 and 45 lack an inventive step under PCT Article 33(3) as being obvious over Mine, U.S. 6,040,362 in view of a table taken from Handbook of Fillers, second edition authored by Wypych. Wypych is cited to illustrate that the fumed silica disclosed by Mine will inherently be micro-sized as required by the claims.

Claims 13 and 47 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a heat-conductive filler that is made available in flake form.

Claims 1-64 meet the criteria set out in PCT Article 33(4), and thus possess industrial applicability because the subject matter claimed can be made or used in industry.

---------- NEW CITATIONS ----------

We claim:

1. (Presently Amended) A thermal interface composition, comprising:

   at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

   at least one inorganic micro-filler material, and

   at least one thermally conductive filler material.

2. (Previously Presented) The thermal interface composition of claim 1, wherein at least one of the siloxane-based compounds comprises a polysiloxane compound.

3. (Previously Presented) The thermal interface composition of claim 1, wherein at least one of the siloxane-based compounds comprises a hydride-functional siloxane compound.

4. (Previously Presented) The thermal interface composition of claim 2, wherein the polysiloxane compound comprises a substituted polysiloxane compound.

5. (Previously Presented) The thermal interface composition of claim 4, wherein the polysiloxane compound is substituted by a functional group comprising an alkyl group, an aromatic group, a halide group or a combination thereof.

6. (Previously Presented) The thermal interface composition of claim 4, wherein the substituted polysiloxane compound comprises an alkenyl-terminated polyalkylsiloxane.

7. (Previously Presented) The thermal interface composition of claim 6, wherein the alkenyl-terminated polyalkylsiloxane comprises a vinyl group.

8. (Previously Presented) The thermal interface composition of claim 7, wherein the alkenyl-terminated polyalkylsiloxane further comprises a methyl group.

9. (Previously Presented) The thermal interface composition of claim 5, wherein the polysiloxane compound comprises vinylmethylcyclotetrasiloxane, polytetradecylmethylsiloxane, polyoctylmethylsiloxane, decylmethylsiloxane, butylated aryloxy- propylmethylsiloxane, octadecylmethylsiloxane, dimethylsiloxane or a combination thereof.

AMENDED SHEET

10. (Previously Presented) The thermal interface composition of claim 3, wherein the hydride-functional siloxane comprises methylhydrosiloxane.

11. (Previously Presented) The thermal interface composition of claim 1, wherein the inorganic micro-filler material comprises silicon dioxide.

12. (Previously Presented) The thermal interface composition of claim 1, wherein the inorganic micro-filler material comprises a powder.

13. (Previously Presented) The thermal interface composition of claim 1, wherein the inorganic micro-filler material comprises a flake.

14. (Previously Presented) The thermal interface composition of claim 1, wherein the thermally conductive filler material comprises a transition metal.

15. (Previously Presented) The thermal interface composition of claim 1, wherein the thermally conductive filler material comprises boron.

16. (Previously Presented) The thermal interface composition of claim 14, wherein the transition metal comprises copper.

17. (Previously Presented) The thermal interface composition of claim 15, wherein the thermally conductive filler material comprises boron nitride.

18. (Previously Presented) The thermal interface material of claim 1, further comprising at least one additive.

19. (Previously Presented) The thermal interface material of claim 18, wherein the additive comprises a catalyst.

20. (Previously Presented) The thermal interface material of claim 18, wherein the additive comprises an inhibitor.

21. (Previously Presented) The thermal interface material of claim 18, wherein the additive comprises a rheological modifier.

22. (Previously Presented) The thermal interface composition of claim 19, wherein the catalyst comprises platinum.

REMAINDER SHEET

23. (Previously Presented) The thermal interface composition of claim 20, wherein the inhibitor comprises an antioxidant.

24. (Previously Presented) The thermal interface composition of claim 21, wherein the rheological modifier comprises at least one solvent.

25. (Previously Presented) A coating composition comprising the thermal interface composition of claim 1.

26. (Previously Presented) A coating composition comprising the thermal interface composition of claim 18.

27. (Previously Presented) An electronic component comprising the thermal interface composition of claim 1.

28. (Previously Presented) An electronic component comprising the thermal interface composition of claim 18.

29. (Previously Presented) An electronic component comprising the coating solution of claim 25.

30. (Previously Presented) An electronic component comprising the coating solution of claim 26.

31. (Previously Presented) A semiconductor component comprising the thermal interface composition of claim 1.

32. (Previously Presented) A semiconductor component comprising the thermal interface composition of claim 18.

33. (Previously Presented) A semiconductor component comprising the coating solution of claim 25.

34. (Previously Presented) A semiconductor component comprising the coating solution of claim 26.

35. (Presently Amended) A method of forming a thermal interface material, comprising:

providing at least two siloxane-based compounds, wherein each compound has a different solubility parameter,

AMENDED SHEET

providing at least one inorganic micro-filler material,

providing at least one thermally conductive filler material, and

combining the at least two siloxane-based compounds, the at least one inorganic micro-filler material and the at least one thermally conductive filler material.

36. (Previously Presented) The method of claim 35, wherein at least one of the siloxane-based compounds comprises a polysiloxane compound.

37. (Previously Presented) The method of claim 35, wherein at least one of the siloxane-based compounds comprises a hydride-functional siloxane compound.

38. (Previously Presented) The method of claim 36, wherein the polysiloxane compound comprises a substituted polysiloxane compound.

39. (Previously Presented) The method of claim 38, wherein the polysiloxane compound is substituted by a functional group comprising an alkyl group, an aromatic group, a halide group or a combination thereof.

40. (Previously Presented) The method of claim 38, wherein the substituted polysiloxane compound comprises an alkenyl-terminated polyalkylsiloxane.

41. (Previously Presented) The method of claim 40, wherein the alkenyl-terminated polyalkylsiloxane comprises a vinyl group.

42. (Previously Presented) The method of claim 41, wherein the alkenyl-terminated polyalkylsiloxane further comprises a methyl group.

43. (Previously Presented) The method of claim 39, wherein the polysiloxane compound comprises vinylmethylcyclotetrasiloxane, polytetradecylmethylsiloxane, polyoctylmethylsiloxane, decylmethylsiloxane, butylated aryloxy- propylmethylsiloxane, octadecylmethylsiloxane, dimethylsiloxane or a combination thereof.

44. (Previously Presented) The method of claim 37, wherein the hydride-functional siloxane comprises methylhydrosiloxane.

45. (Previously Presented) The method of claim 35, wherein the inorganic micro-filler material comprises silicon dioxide.

AMENDED SHEET

46. (Previously Presented) The method of claim 35, wherein the inorganic micro-filler material comprises a powder.

47. (Previously Presented) The method of claim 35, wherein the inorganic micro-filler material comprises a flake.

48. (Previously Presented) The method of claim 35, wherein the thermally conductive filler material comprises a transition metal.

49. (Previously Presented) The method of claim 35, wherein the thermally conductive filler material comprises boron.

50. (Previously Presented) The method of claim 48, wherein the transition metal comprises copper.

51. (Previously Presented) The method of claim 49, wherein the thermally conductive filler material comprises boron nitride.

52. (Previously Presented) The method of claim 35, further comprising at least one additive.

53. (Previously Presented) The method of claim 52, wherein the additive comprises a catalyst.

54. (Previously Presented) The method of claim 52, wherein the additive comprises an inhibitor.

55. (Previously Presented) The method of claim 52, wherein the additive comprises a rheological modifier.

56. (Previously Presented) The method of claim 53, wherein the catalyst comprises platinum.

57. (Previously Presented) The method of claim 54, wherein the inhibitor comprises an antioxidant.

58. (Previously Presented) The method of claim 55, wherein the rheological modifier comprises at least one solvent.

59. (Previously Presented) A coating composition produced from the method of claim 35.

60. (Previously Presented) A coating composition produced from the method of claim 52.

61. (Previously Presented) An electronic component comprising the coating solution of claim 59.

AMENDMENT SHEET

62. (Previously Presented) An electronic component comprising the coating solution of claim 60.

63. (Previously Presented) A semiconductor component comprising the coating solution of claim 59.

64. (Previously Presented) A semiconductor component comprising the coating solution of claim 60.

AMENDED SHEET